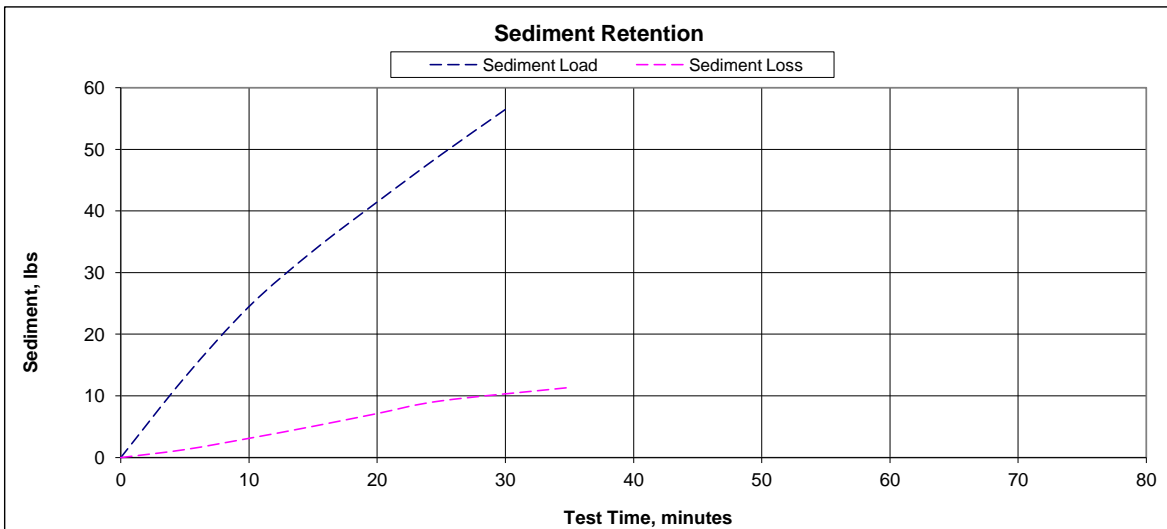
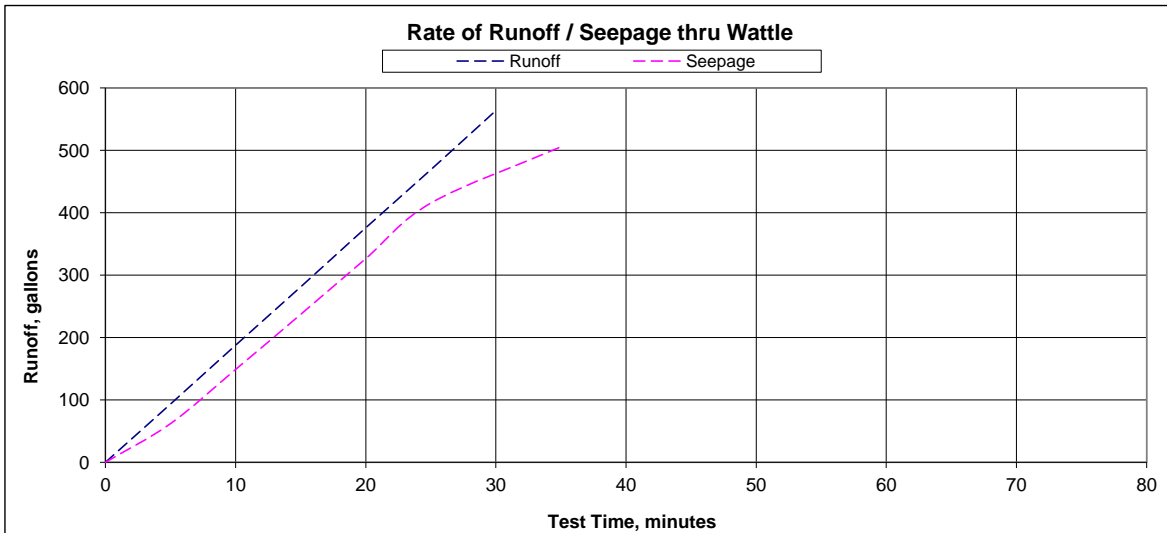


Project: ASTM D 7351 modified for Inlet
Client / Listing # / Product: NTPEP / ECP-2019-03-007 / BioD-SiltTrap 12
Test Date: 3/26/2020
Test Setup: Inlet Protection Installation per Manufacturer Recommendation
Duration: 30 minutes
Water / Soil Input: 4700 lbs water 57 lbs soil
Sediment Concentration: Sandy Clay @ 1.2%

Soil Retention Effectiveness: 80.05%
Water Retention Effectiveness: 10.29%
Seepage Effectiveness: 89.71%



The testing is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose

Testing Overview

The large-scale testing reported herein was performed in general accordance with ASTM D 7351 modified to present the flow to an area inlet. For this testing, a simulated area inlet installation comprised of an approximate 24-inch x 24-inch opening simulating a manhole inlet positioned at the center of a containment area was used. The SRD was installed inside of the inlet opening according to manufacturer recommendations and exposed to simulated runoff. Sediment-laden water was piped and discharged into the fully contained area around the inlet opening and allowed to run into and seep through the installed inlet protection SRD. The amount (via water and soil weight) of sediment-laden flow was measured both upstream and downstream of the SRD. The measurement of sediment that passes through the installed SRD is compared to the measured amount in the upstream flow and is used to quantify the effectiveness of the SRD in retaining sediments while allowing continued seepage. The measurement of water that passes through the installed SRD compared to the amount of the upstream flow is used to quantify the effectiveness of the SRD in allowing continued seepage.

SRD "Benchmark" Testing

Prior to testing, samples of the SRD are submitted for index testing in order to establish "benchmark" properties of the product tested. SRD index properties from independent laboratory testing are presented in Table 1.

Table 1. "Benchmark" Test Results (Tested Product - 3 units received)

Property	Units	Average	Range
Length	in.	119.3	115.0 - 122.0
Weight (as received)	lb	12.2	11.58 - 13.30
Height	in.	11.5	11.35 - 11.65
Depth	in.	4.8	4.58 - 4.91
Density	lbs/ft ³	3.2	3.17 - 3.30

Test Setup

The test procedure requires an integrated system of equipment to accomplish the full-scale testing of inlet protection SRDs. The system used for this testing includes the following components:

- A tank with an internal paddle mixer device mounted on scales capable of holding/weighing 10,000 lb of sediment-laden water.
- An elevated simulated storm drain inlet with a fully contained area for upstream ponding and downstream accessibility for sampling.
- A tank mounted on scales of sufficient volume to collect all runoff passing the SRD.

Concentrated sediment-laden flow is conveyed by pipe from the mixing tank to the simulated storm drain inlet located between the mixing and collection tanks. The fully contained simulated inlet includes a retention zone surrounding an installation zone. The installation zone is about 1.5 feet wide and encircles the inlet opening and is comprised of prepared soil subgrade to allow full-scale installation of the SRD. The discharged sediment-laden water is allowed to run up to and seep through, over, and/or under an installed SRD protecting the simulated inlet. The seepage migrates through the inlet opening and drains into the collection tank.

Test Soil

The test soil used in the test plots had the characteristics shown in Table 2.

Table 2. Test Soil Characteristics

Soil Characteristic	Test Method	Value
% Gravel	ASTM D 422	0
% Sand		50
% Silt		12
% Clay		38
Liquid Limit, %	ASTM D 4318	50
Plasticity Index, %		26
Soil Classification	USDA	Sandy Clay
Soil Classification	ASTM	Fat Clay (CH)

Preparation of the Installation Zone

In the event that the SRD submitted for testing requires an unpaved subgrade zone for the installation of stakes, posts, or other anchoring devices, the subgrade installation zone is exposed in the test apparatus. The installation zone subgrade soil is placed and compacted. Compaction is verified to be 90% (± 3%) of Standard Proctor density and moisture content is verified to be within ±3%

Inlet Protection SRD Installation

The inlet protection SRD is installed in the installation zone in accordance with the provided installation instructions and as shown in the pictures herein. Close-ups of the tested SRD unit are shown below.



Mixing Sediment-Laden Runoff

Sediment-laden runoff was created by combining water and soil in the mixing tank and agitating during the test. 4700 lb of water and 57 lb (dry weight) of test soil were combined to create the sediment-laden runoff of 1.2% (12000 mg/L). These quantities represent the "default" condition given in the standard which is a hypothetical 30-minute, peak flow from a 24-hour, 4-inch rainfall on a 100-ft long x 20-ft wide bare soil slope.

Specific Test Procedure

After the SRD is installed, the sediment-laden runoff is discharged evenly for 30 minutes while agitation is maintained. The quantity of released runoff is measured at 5-minute intervals by noting the reduction in weight in the mixing tank, adjusting the valve on the tank outlet to increase/decrease flow to stay as close as possible to the target ($4757 \text{ lb} / 30 \text{ min} = 159 \text{ lb} / \text{min}$). For this testing, the discharge flow is introduced to allow it to flow up to and into the SRD. Retention observations and ponding depths, and associated times, are recorded during the test. As runoff passing the SRD system is collected, the weight and volume of the collection tank is recorded and grab samples are taken, at 5 minute intervals. Cutoff time is the earlier of 90 minutes or when there is low-volume ponding and minimal discharge. Grab samples are evaluated in a lab to determine turbidity (using a Hach 2100 AN Turbidimeter) and to determine percent dry solids content. Drying of collected sediments is accomplished in a forced air oven at 110°C for a minimum of 24 hours or until all moisture is driven off, whichever is greater. All weighing of sediments is done with laboratory scales accurate to ± 0.01 grams.



Test Setup and Installation Zone around 24-in x 24-in Inlet



SRD Installation



Test Flow and Ponding Increasing



Mid-way and End-of-Test

APPENDIX - DATA

ASTM 7351 Soil Retention and Water Seepage Effectiveness

Client / Product: NTPEP / ECP-2019-03-007 / BioD-SiltTrap 12

Soil: DDRF Sandy Clay - 1.2% Sediment Concentration

Test Setup: Inlet Protection Installation per Manufacturer Recommendation

Date: 3/26/2020

Start Time: 3:02 PM

End Time: 3:32 PM

Sample Number	Test Time, minutes	Turbidity	Total Weight, g	Dry Weight, g	Bottle Weight, g	Dry Sediment Weight, mg	Total Collected Water Wt., g	Total Collected Volume, l	Sediment Conc., mg/l	% Solids	Reservoir Weight, lb	Assoc. Water Discharge, gal	Cumm Water Discharge, gal	Coll. Tank Depth, mm	plot time	SRD Ponding Height, mm	Cumm Soil Loss, lbs	Assoc. Solids Loss, lbs	Soil Retention Effectiveness, %	Water Retention Effectiveness, %	
Upstream																			0		
B0	0	99999	389.00	160.31	156.33	3980	72.36	0.25	15920	1.71%	4757	93.3	93.3		5.0		13.0	13.0			
B5	5	2706	382.37	160.39	156.82	3570	65.16	0.25	14280	1.58%	3966	94.3	187.6		10.0		24.5	11.5			
B10	10	3035	389.85	159.38	156.37	3010	74.10	0.25	12040	1.29%	3168	93.4	280.9		15.0		33.5	9.0			
B15	15	3580	386.28	159.2	156.90	2300	70.18	0.25	9200	1.00%	2380	94.7	375.6		20.0		41.5	7.9			
B20	20	4036	392.93	158.99	156.66	2330	77.28	0.25	9320	0.99%	1582	93.1	468.7		25.0		49.1	7.7			
B25	25	4448	390.59	159.17	156.89	2280	74.53	0.25	9120	0.98%	798	94.8	563.5		30.0		56.5	7.3			
B30	30	4819	374.37	157.07	155.19	1880	62.11	0.25	7520	0.86%	0	-	-		-		-	-			
Water Added To Mixer (lbs): 4700			Soil Added To Mixer (lbs): 57				AVGS:		11057	1.20%	TOTALS:		563.5					56.5			
Downstream																			0		
A0	0	4510	-	-	-	-	-	-	-	0.25%	0	61.9	61.9	0.0	5	0.0	1.3	1.3	80.05%	10.29%	
A5	5	1884	370.72	157.58	157.04	540	56.10	0.25	2160	0.25%	518	86.8	148.8	36.0	10	25.0	3.1	1.8			
A10	10	2000	377.80	157.88	157.33	550	62.59	0.25	2200	0.25%	1244	88.2	237.0	73.0	15	35.0	5.1	1.9			
A15	15	2664	354.09	156.89	156.34	550	40.86	0.25	2200	0.28%	1982	89.4	326.4	114.0	20	34.0	7.1	2.1			
A20	20	2590	363.80	157.59	157.02	570	49.19	0.25	2280	0.28%	2730	88.9	415.3	150.0	25	40.0	9.2	2.1			
A25	25	3412	354.27	157.52	156.97	550	39.78	0.25	2200	0.28%	3474	90.1	505.5	187.0	35	45.0	11.4	2.2			
A30	30	3415	357.37	157.64	157.05	590	42.68	0.25	2360	0.29%	4228	-	-	227.0	-	54.0	-	-			
A35	35																				
A45	45																				
A60	60																				
A75	75																				
A90	90																				
									2233	0.27%	4228	505.5						11.4			
Soil Collected (lbs):			n/a			(avg)		(avg)		(total)		(total)							(approx.)		